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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/636,050	08/07/2003	Kwang Chul Joo	29936/39456	1009
4743	7590	03/29/2004	EXAMINER	
MARSHALL, GERSTEIN & BORUN LLP 6300 SEARS TOWER 233 S. WACKER DRIVE CHICAGO, IL 60606			ANYA, IGWE U	
			ART UNIT	PAPER NUMBER
			2825	

DATE MAILED: 03/29/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/636,050

Applicant(s)

JOO, KWANG CHUL

Examiner

Igwe U. Anya

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 07 August 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-9 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-3 and 5-9 is/are rejected.
- 7) ☒ Claim(s) 4 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 07 August 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### ***Claim Rejections - 35 USC § 103***

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1 – 3, 5 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Clementi et al. (US Patent 5600166) in view of He et al. (US Patent 6020238).

3. Clementi et al. teach a method of forming a non-volatile memory, comprising forming a floating gate (5), nitrifying the surface of the floating gate, forming a silicon nitride (6) layer of thickness 50 – 150 angstroms using ammonia and SiH<sub>2</sub>Cl<sub>2</sub> gas at a temperature of 780 degrees C (col. 5 lines 44 – 65); and forming a control gate.

4. Clementi et al. lack nitrification of the floating gate using ammonia, a metal oxide in the gate capacitor layer, and annealing the gate the metal oxide.

5. However, He et al. teach nitrification using ammonia as conventional in the art, forming a tantalum oxide in the gate capacitor layer to a thickness of 300 – 400 angstroms on a silicon nitride film using a tantalum precursor as the source gas for high capacitance (col. 4 lines 27 – 48), and annealing in nitrous oxide atmosphere to supplement oxygen and remove carbon contaminants (col. 4 lines 50 – 65). Formation of native oxide on the nitrated surface after nitrification is inherent of exposure to the atmosphere.

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6. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the teachings of He et al. into the Clementi et al. reference to increase coupling ratio and reduce the gate control voltage.

7. Claims 6, 8 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Clementi et al. (US Patent 5600166) in view of He et al. (US Patent 6020238), and further in view of Chang et al. (US Patent 6461949).

8. The Clementi/He et al. reference teach the features previously outlined, but lack forming the metallic oxide using a metal precursor as a source gas and oxygen as the reaction gas, annealing the metal oxide by RTP at a temperature of 700 - 900 degrees C, and LPCVD of the nitride layer.

9. However, Chang et al. teach forming the metallic oxide using a metal precursor as a source gas and oxygen as the reaction gas (col. 3 lines 1 - 29), annealing the metal oxide by RTP at a temperature of 800 degrees C (col. 3 lines 29 - 36), and LPCVD of the nitride layer using ammonia and  $\text{SiH}_2\text{Cl}_2$  (col. 2 lines 62 - 67).

10. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the teachings of Chang et al. into the Clementi/He et al. reference to fabricate a low voltage non-volatile memory.

11. Prior art considered, but not used in the rejection include Joo et al. (US Patent 6396099).

12. Claim 4 is objected to as being dependent upon a rejected claim, but would be allowable if rewritten in independent form.

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13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Igwe U. Anya whose telephone number is (751) 272-1887. The examiner can normally be reached on M - F 8:30am - 5:00pm.


If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew S. Smith can be reached on (751) 272-1907. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Igwe U. Anya  
Examiner  
Art Unit 2825

IA

March 8, 2004



MATTHEW SMITH  
SUPERVISORY PATENT EXAMINER  
TECHNOLOGY CENTER 2800